SECTION 15189
CHEMICAL TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this section.

1.2 SUMMARY

A. Provide chemical treatment systems for the following systems in accordance with requirements of the Contract Documents.
   1. Chilled water (CHW, closed system).
   2. Heating hot water (HW, closed system).
   3. Condenser water (CND, open system).
   4. Technical Equipment Cooling Water (TW, open system).

B. Related Sections: The following Sections contain requirements related to this Section:
   1. Section 15072, “Cleaning”
   2. Section 15075, “Disinfection”

1.3 SUBMITTALS

A. Procedures: Furnish submittals in accordance with the general requirements specified in General and Supplementary General Conditions.

B. Shop Drawings: Furnish shop drawings for the installation of the chemical treatment systems. Prepare layouts in plan at not less than 1/8" = 1'-0" and equipment room plans not less than 1/4" = 1'-0".
   1. Provide equipment and piping layout and details.

C. Product Data: Submit a material list with system diagram and technical data documenting the primary function, quality, and performance of each system to be used, e.g., the primary characteristics as required by the Drawings or Specifications. Furnish a listing for each of the following:
   1. Valves and Identification Brochure.
   2. Pipe and Fittings.
   3. Treatment equipment including pumps, tanks, meters, etc. (manufacturer's catalog cuts and literature).
   4. Cycles of concentration calculations listing make-up backflush or blowdown gpm requirements (cooling tower systems).
   5. Pump performance curve data sheets.
   6. Chemical(s) product data sheets.
   7. Assembly and Operating Instructions.
   8. Maintenance Programs.
   9. Wiring Diagrams.
   10. Spare Parts Lists.

D. Certifications: Submit certifications for the chemical treatment system water quality.

E. Project Record Drawings: Submit TO construction Manager project record drawings annotated with the changes made during installation of the system so as to be a complete set of "as installed" plans, piping, and wiring diagrams.

1.4 QUALITY ASSURANCE

A. Subcontractors Quality Assurance Responsibilities: Subcontractor is solely responsible for quality control of the Work. Comply with the requirements specified in General and Supplementary Conditions for Quality Control.
   1. Must be a company solely engaged in providing water treatment chemicals and services
   2. Must have a laboratory capable of performing any and all required water, deposit, biological, metallurgical and corrosion analysis'.
   3. Must have a laboratory capable of performing any and all required water, deposit, biological, metallurgical and corrosion analysis'.
   4. Must maintain a 24 hour per day, 7 day per week telephone contact in the event of a chemical spill or emergency.

B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions.

1.6 MAINTENANCE AND ACCEPTANCE

A. Maintenance and Operating Manuals: Submit to Construction Manager complete manuals describing the materials, devices and procedures to be followed in operating, cleaning, and maintaining the chemical treatment system. Assemble manuals for component parts into single binders identified for each system. Include manufacturer's brochures, valve identification brochure, and parts lists describing the materials used and other major components including the following:
   1. Wiring diagrams.
   2. Exploded views of oxide generator components and list of materials

B. Instructions: Prior to CM's acceptance, establish with the CM an instruction and training program for his personnel. Notify the CM in writing at least 7 days prior to commencement of the program providing an outline of topics indexed to the Maintenance and Operating Manual. Furnish a trained instructor for two consecutive 4-hour periods of training scheduled during the normal 8 hour working day. Instruction and training includes, but is not limited to, the following:
   1. Use of the Maintenance and Operating Manual to maintain and operate the system.
   2. Owner's responsibilities for warranties and maintenance.
   3. Use of test kits.
   4. Execution and interpretation of routine chemical tests.

C. Post Start-Up Services: Provide supervisory consulting services by periodic inspection visits at least every month during the first 3 months of operation, written reports to the Owner with recommendations, and an inspection visit every other month, minimum, thereafter, for the first year.

PART 2 - PRODUCTS

2.1 GENERAL

A. Piping Materials: Refer to Section 15050 - Basic Mechanical Materials and Methods.

B. Electric power to be provided to all system components. All control and interlock wiring to be in conduit and in accordance with Electrical Specifications.

2.2 CHEMICALS

A. General: Provide required amount of completely water soluble chemicals for initial system cleaning and fill and one year's supply, consisting of a blend of chemicals as recommended by the chemical treatment supplier and acceptable to EPA requirements.

B. Detergents, solvents, and other cleaning agents shall be compatible with systems materials where they are used. No cleaning agent shall adversely affect materials or mechanisms in systems, and cleaning agents shall be acceptable to equipment manufacturers.

C. Detergents, solvents, and other cleaning agents shall be compatible with process streams to be handled by systems in which the cleaning agents are used.

D. Owner will provide water for pipe cleaning and flushing. Subcontractor shall provide other cleaning fluids, agents, and equipment. Remove contaminated fluids from the site.

2.3 WATER SAMPLING NOZZLE

A. General: Provide suitable sampling valve, pipe and fittings in each system.

2.4 CHEMICAL TEST KIT

A. General: Provide one chemical test kit suitable for testing water samples, installed in location as directed. Supply the kit with necessary glassware, standard solutions, reagents, indicators, electrical conductivity meter with probe, and assessory equipment.

B. Water Sample Tests shall include:
   1. Hardness - Versonate Titration Method.
   2. P & M Alkalinity - Sulfuric Acid - Titration Method.
   3. Chloride - Silver Nitrate - Titration Method.
   4. Nitrite-Ceric Sulfate - Titration Method.
   5. Phosphonate and/or Tracer - Titration Method.
   6. pH Value - Taylor Method - with slide comparator and 4 oz. bottles of the following indicators.
      a. Bromthymol Blue (6.0-7.6)
      b. Cresol Red (7.2-8.8)
      c. Thymol Blue (8.9-9.6)

2.5 CLOSED LOOP, CHEMICAL TREATMENT SYSTEM (FOR CHILLED WATER SYSTEM AND HEATING HOT WATER SYSTEM)

A. General: Provide a complete chemical feed system for the addition of chemical treatment to all closed loop systems. The chemical feed system shall consist of bypass feeders, chemicals, water sampling nozzles, and chemical test kits.

B. Bypass Feeders:
   1. General: Provide cast iron or steel chemical bypass feeder with capacity as scheduled, rated at 150 psig and 200 degrees F for introducing water treatment into

each closed water system. Feeder shall be furnished with chemical tank with quick-opening top fill cap, two shutoff ball valves in the inlet and outlet lines, one drain valve and one reducing bushing for drain valve. Feeder shall be supported on a column, by integral support legs, pipestand or wall in a convenient location. Bypass feeder shall be suitable for system working pressure.

2. Feeder lead-in line shall be taken from the pump discharge header. Feeder outlet line shall run to the pump suction header. Provide a sampling connection with a 1/4-inch ball valve.

C. Chemicals: Provide one year's supply of the required chemicals used to control scale and corrosion in the piping system.

2.6 OPEN-LOOP, CONDENSER (COOLING-TOWER) WATER SYSTEM (CND) AND TOWER WATER SYSTEM (TW)

A. General:
1. Provide a complete chemical treatment system for the addition of chemicals to cooling tower water and condenser water systems.
2. The chemical treatment system shall function on the basis of the pH, ORP and conductivity of the treated cooling water.

B. Chemical Feed and Bleed-Off Control Equipment.
1. pH/Conductivity Inhibitor Control:
   a. Flow assembly designed to monitor and control Total Dissolved Solids (TDS) through an open recirculating system. Controller shall be complete with readout meters for pH (0-10) and conductivity (0-5,000 mm); sample stream flow switch; PVC flow cell assembly for mounting of the pH measurement electrode, pH reference electrode and conductivity electrode; acid overfeed timer; and output contacts rated for 5 amps at 115V. Controller, sample stream flow switch, flow cell assembly and acid overfeed timer shall be factory mounted and wired, and furnished as a complete assembly.
   b. Pressure switch, 115V/1ph/60hz shall be mounted on the condenser water pump discharge header, for interruption of the power supply to the chemical treatment control panel in the event of loss of condenser water flow. Switch shall have double adjustment differential, mercury contacts and shall be furnished with a general purpose NEMA 4x enclosure. Feed rate shall be adjustable while the pump is running.
2. Bleed-Off Equipment:
   a. Normally closed bleed-off solenoid valve, 115V/1ph/60hz.
   b. Bleed-off flow rate control valve, shall be sized to bleed twice the maximum bleed rate of the system.
3. Chemical Pumping and Storage Equipment (for pH, Conductivity and Inhibitor Control).
   a. Duplex chemical pump, shall be positive displacement type PVC construction, 115V/1ph/60hz with suction and discharge tubing and fittings. Chemical pump shall take suction from the liquid treatment storage tanks. Subcontractor shall furnish and install conduit for carrying the discharge tubing from the chemical pump to the point of injection. Pump shall be furnished with a foot valve, injection fittings, and anti-siphon/pressure relief valve rated at 100 psig.
   b. Storage tanks for chemical feed shall be heavy wall, high density polyethylene tanks with covers. Subcontractor shall provide and install 1/2" O.D. polyethylene tubing encased in 3/4" thinwall electrical conduit between acid pump and discharge connection and injection assembly.
   c. Injection assembly consisting of a 1/2" Ball valve, suitable injection nozzle/quill and 1/2" thread-o-let welding fitting.

C. Biocide Feeding Equipment: Provide oxidant generator and distribution equipment as follows:

D. Chemicals:
1. For Scale and Corrosion Control:
a. Provide a multi-purpose liquid formulation for the control of scale and corrosion.
b. Treatment shall be capable of limiting corrosion to not more than 5 mils penetration per year.
2. Biocides For Algae, Fungi, Slime and Bacteria Control: Biocide control will inhibit the growth of algae, fungi, bacteria and other slime type deposits. Biocide residuals will be verified by free chlorine tests and additional bacteria and fungi monitoring by dip slides and other methods will be performed as needed. Legionella control in accordance with ASHHRAE and Cooling Tower Institute protocol.
a. Oxidant generator driven by a 420 ma signal from ORP controller. Oxidant Generator shall be able to be powered by 208V 1 phase 20 Amp circuit. 2 required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine the areas to receive the Work and the conditions under which the Work would be performed. Subcontractor shall remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Refer to Section 15050 - Basic Mechanical Materials and Methods.

3.3 PIPING SYSTEMS CLEANING

A. Systems shall be operational, filled, started, and vented prior to cleaning.

B. Water treatment shall be designed to provide maximum protection against scale formation at points of heat transfer and the corrosion of ferrous and non-ferrous metals throughout the system. After the system has been thoroughly cleaned and flushed, treatment will be established at a high level to achieve maximum passivation of metallic surfaces. After operations are stabilized, treatment levels shall be adjusted at lower level for normal operation.

C. Cleaning piping systems in accordance with Section 15072, “Cleaning”.

D. Services:
1. Provide services for the installation, cleaning, treatment and certification of the specified systems.
2. Startup and training of the operating personnel with respect to the water treatment system technology related to this installation.
3. Monthly visits for a period of one year by a qualified field Engineer for this purpose of conducting water tests on the premises and collecting samples from various water related equipment for complete laboratory analysis.

3.4 FIELD QUALITY CONTROL

A. Test Procedures: Test in accordance with Section 15990 - Testing, Adjusting, and Balancing.

B. Start-Up: Provide services of a chemical Engineer, registered in the State of Tennessee, for the following:
   1. Verify suitability of proposed chemicals with materials in system.
   2. Inspect and checkout the installation to ensure compliance with Contract Documents.
   3. Assist in start-up to ensure satisfactory operation.
   4. Supervise injection of dosage of chemical treatments to establish prescribed chemical balance and concentrations in the system.
   5. Set up test kit.

3.5 ADJUSTING

A. Upon completion of the Work, repair surfaces that have been permanently stained, marred, or otherwise damaged. Replace Work which is damaged or cannot be adequately cleaned as directed.

3.6 CLEANING

A. Upon completion of the Work, remove unused materials, debris, containers and equipment from the project site. In addition to the initial cleaning procedure required, and not more than 2 days before occupancy by the Owner, clean the Work as recommended by the manufacturer.

3.7 PROTECTION

A. Protect the Work during the construction period so that it will be without any indication of use or damage at the time of acceptance. Protection includes, but is not limited to, the following:
   1. Temporary plugs or caps for piping.

3.8 WATER TREATMENT SERVICE PROGRAM

A. Provide all consulting services for a period of one year from the time of start-up of the system which will include:
   1. Installation and start-up recommendations
   2. Water analysis and recommendations
   3. Training of personnel in proper feed and control.
   4. Minimum monthly service calls.
   5. Log sheets and record forms.
   6. All required chemicals.

END OF SECTION 15189